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PATENT AND TECHNICAL TRANSLATION

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DECLARATION

The undersigned, Olaf Bexhoeft, hereby states that he is well acquainted with both the English and German languages and that the attached is a true translation to the best of his knowledge and ability of the German text of PCT/DP03/00672, filed 02/28/2003 and published 10/23/2003 under No. WO 03/086923, and of twenty-three (23) amended claims.

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.

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Specification

Devices for Aligning Sheets and Method for Aligning Sheets Transversal to the Direction of Travel of the Sheets

The invention relates to devices for aligning sheets and to a method for aligning sheets transversely to the direction of travel of the sheets in accordance with the preambles of claims 1, 2, 4, 5, 7 or 29.

Pull guides are known in various embodiments, which pull each sheet mainly by static friction against a fixed stop - the actual side mark. After arriving there, the sheet can immediately come to rest, because the pulling mechanism, which is only in slight contact with it, continues to pull on the sheet, but the static friction immediately is switched to sliding friction.

Driven pulling rails, pulling rollers or pulling segments exist in the sheet-feeding table. If the sheet has arrived at the front marks, it is first pushed from above on the driven portion of the pulling device underneath the sheet by means of a roller, which can be precisely adjusted, is spring-loaded and is cyclically moved up and down. The length of the pull of the pull guide is always slightly greater than the scatter width of the incoming scaled layers of sheets, plus a minimum pulling length of a few millimeters up to the fixed side mark stop. The latter is adjustably fastened on the sheet-feeding table or the comb plate, depending on the sheet format and the desired lateral position of the sheets running into the printing press.

These known pull guides have the disadvantage that they clamp the sheet from above and below in the course of pulling it

in. For this reason the pull guide must remain open at the end of the pulling operation until each sheet end has passed the pull guide line, i.e. has cleared it. Only then can the successive sheet, which is already located in the front marks, be pulled by the pull guide. The respectively third sheet of the incoming stream of scaled sheets must be sufficiently remote from the front marks and the pull guide line so that it has not yet reached the clamping pull guide working on the second sheet, i.e. is closed.

For rapidly running sheet printing presses it is customary to keep the plate and rubber blanket cylinders as small as possible. In that case the paper running times are shorter, and the manufacturing expenses less. The sheet length often can be 3/4 to 5/6 of the plate cylinder circumference, i.e. the cylinder grooves are short and the sheets follow each other very closely. Clamping pull guides no longer function, because the long sheets clear the pull guide lines too late for pulling the next sheet. In these cases suction pull guides are used, in which the pressure roller from above is omitted.

A driven suction pull guide strip is located in the feed table and pulls each sheet in by means of a sufficient number of small suction air holes, and pulls it transversely in relation to the running direction of the sheets against a fixed side mark. In this case the suction air is adjusted for each paper thickness up to cardboard so finely, that each sheet is pulled by the suction orifice against the side mark by means of static friction and is deposited there, while the sliding friction, which now starts automatically, allows the further movement of the suction strip up to dead center.

Thus, known suction pull guides only act on the sheet from below without clamping effects. They make possible an operation

in the covered state of the preceding sheet end, and therefore greater sheet output per hour than clamping pull guides. However, it is disadvantageous that the third successive sheet, which is moved in underneath the sheet respectively to be aligned in the scaled flow, must not reach the working pull guide - the same as with clamping pull guides - because it cannot get through between the second sheet grasped by means of suction and the suction orifice. It can only do so if the suction pull guide does not operate, i.e. is "open" for sheets moving up from below.

The disadvantages of the known clamping and suction pull guides for the lateral alignment of sheets could be avoided if a lateral pulling device operating from above were provided.

DE 33 05 219 C2 describes the employment of a suction pull guide for very short scale distances, operating from above.

A device for the lateral alignment of sheets is known from DE 100 55 564 A1, wherein an effective suction surface is greater in the conveying direction of the sheets than in the transverse direction.

DE 33 02 873 C2 discloses a suction gripper acting from above, which is lifted for further conveying a successive sheet underneath the sheet which is just to be aligned.

DE 11 10 656 B shows a back-and-forth pivotable suction segment for the lateral alignment of sheets.

The object of the invention is based on providing devices for aligning sheets, and a method for aligning sheets transversely to the direction of travel of the sheets.

In accordance with the invention, this object is attained by means of the characteristics of claims 1, 2, 4, 5, 7 or 29.

The advantages to be gained by means of the invention lie in particular in that a suction pull arrangement, which acts from

above, operates without clamping effects. It allows for the first time the passage underneath the pull guide line by the following sheet while the pull guide still pulls a sheet, which has been placed against the front marks, laterally against a fixed lateral edge stop.

By virtue of the novel "suction pull guides from above", the sheets can run in an advantageous manner at very close scale distances, i.e. considerably slower, on the feed table to the front marks and reach them at an earlier time, because there is no longer an entering blockage for the sheets. The pull guide line is always open, because all clamping effect toward the bottom to the feed table is lacking. Because of the early arrival at the front marks, considerably longer time frames are available for front and lateral edge alignment. This permits correspondingly higher machine speeds, without keeping the actual alignment times in milliseconds shorter than customary.

In a further embodiment of the "suction pull guide from above", it can be combined with the small lateral offset, known per se, of the sheets entering the printing press. In this case the suction pull guide from above can already operate if the sheet end of the previous sheet still covers the pull guide line, while simultaneously a successive sheet also passes underneath the pull guide line. In this novel way there are not only two sheets, as up to now, but three sheets simultaneously in the area of the pull guides. This explains how, in spite of considerably greater numbers of revolution of the press, identical or longer sheet alignment times are made available by suction pull guides from above.

An exemplary embodiment of the invention is represented in the drawings and will be described in greater detail in what follows.

Shown are in:

Fig. 1, the left corner of the feed table from above,

Fig. 2, a section through the suction pull guide in the feed table,

Fig. 3, the drive mechanism of the shiftable suction roller,

Fig. 4, a way/time diagram of the sheet feeding device with a classic pull guide,

Fig. 5, a way/time diagram of the sheet feeding device with the side mark in accordance with the invention.

Several front marks 02 are located on a feed table 01 in Fig. 1, which open toward the bottom. There are side marks 03 with cover marks 04. The cover marks 04 are located underneath a suction roller 05 in the grooves of the latter. The suction roller 05 has two oppositely located rows of suction holes 06, of which the upper row is visible. The suction roller axle journals rotate in two bearing arms 07, which are adjustably fastened on the feed table outside of the paper format. Suction air is conducted into the suction roller 05 through a hose 09 and is conducted to the inside of the suction tube wall by means of a slit mouthpiece 22, which can only be seen in Fig. 2. The axis of the suction roller is located parallel with the running direction L of the sheets and in the vicinity of the lateral sheet edge to be aligned. Driving of the suction roller 05 is provided via a toothed belt pulley 14, a toothed belt 15 and a pinion 16 of a constant speed shaft in the sheet delivery device or on the printing press or, for example, via its own rpm- or positionally-

regulated electric drive mechanism by means of an electronic shaft.

In accordance with Figs. 1 to 3, the two suction hole rows of the suction roller 05 rotate at half turns, i.e. the suction roller 05 is arranged in such a way that it performs half a turn per sheet 10, 11, 12 to be aligned. The suction roller 05 has an advantageous diameter between 50 and 60 mm. It can also be constructed differently, for example for one-third turns.

Accordingly, the suction roller 05 is arranged in such a way that it performs 1/N revolutions per sheet 10, 11, 12 to be aligned, wherein N = 2, 3, 4 ..., i.e. a whole number greater than 2.

The suction roller 05 is arranged to perform 1/N revolutions per sheet 10, 11, 12 to be aligned. In this case N = 2, 3, 4 ..., i.e. a whole number greater than 2.

Fig. 1 shows a sheet 10 running into the printing press via front marks 02, which is, after lateral alignment at side marks 03, grasped by a conventional sheet feeder, for example from below by means of a swinging gripper, or by means of suction-push feeders from below, while lying in the front marks 02, and is pulled off the feed table 01 under acceleration. In the course of this, the sheet feeder is axially offset, i.e. transversely to the sheet running direction L, by an always constant amount A of, for example, 26 mm. Because of this, the narrow suction slit, located approximately underneath the center axis of the suction roller 05 and having a width of 6 mm, for example, is uncovered over its entire suction roller length from the lateral edge of the outrunning first sheet 10.

Fig. 1 shows that the end of the sheet 10 has not yet left the area of the suction roller. However, the lateral displacement

A makes it possible that the suction roller has already actively pulled the next, second sheet 11, which is already located in the front marks 02, toward the left against the side marks 03. The sheet feeding of this second sheet 11 can start soon, even if the end of the first sheet 10 still covers the front marks 02.

A third sheet 12, which has already arrived in the area of the suction roller 05, slowly moves in the direction toward the front marks 02. Since it lies underneath the sheet 11, which is just being pulled against the side marks 03 by the suction roller 05 acting from above, the suction roller 05 cannot yet grasp the third sheet 12 by means of suction. This only takes place in the next period, when the second sheet 11, laterally displaced by the distance A - the same way as now the first sheet 10 - enters into the press and uncovers the suction slit in the suction roller 05 for the third sheet 12, etc. A tolerance strip 13 of, for example, ± 6 mm has been drawn in hatched lines. The individual scaled sheets move with this maximum amount of scattering on the feed table 01 from the sheet feeder into the front marks 02. The active narrow, but long suction conduit of the suction roller 05 located above the stream of sheets is located underneath the center line of the suction roller 05 between the sheet inlet tolerance strip 13 and the lateral edge of all arriving lateral sheet edges, which are offset by the amount A from the side marks 03. This is the strip identified by B. With this arrangement, the suction roller 05 catches all sheets 10, 11, 12 of the scaled stream arriving inside the tolerance strip 13, but not the offset lateral edges of all incoming sheets 10, 11, 12.

The ratio of the effective holding surface in the longitudinal direction 105 to the effective holding surface in the

transverse direction b05 should be greater than 3, preferably greater than 5.

The three sheets 10, 11, 12 are arranged between two straight lines 23, 24, which delimit the effective holding surface of the holding device 05 and extend transversely in respect to the running direction of the sheets.

Fig. 2 shows the suction roller 05 above the feed table/comb plate 01. The first sheet 10 enters the press offset from the side mark 03 by the distance A, for example 26 mm. It lies to the right of the suction roller center outside of the suction air conduit 22.

The second sheet 11 is pulled against the side mark 03 by one of the two raised suction air segments with suction holes 06. Several cover marks, or guide tongues 04, project past the side marks 03 into the grooves as far as approximately the center underneath the suction roller 05. The cover marks 04 prevent thin sheets 10, 11, 12 from arching in the nip between the feed table 01, the side mark 03 and the suction roller 05 when coming into contact with the side marks 03.

The two active suction hole segments of the suction roller 05 are located opposite each other and, with a suction roller 05 revolving at half turns, are approximately 30° to 40° long, so that a long pulling time angle of approximately 90° and a pulling path of the suction roller 05 of approximately 20 mm results.

The revolving suction roller 05 itself can provide the clocked switching on and off of the suction air for lateral pulling. For this purpose, suction air holes 06 are only located in the two oppositely placed 45° segments. A stationary pipe 21 is located inside the revolving suction roller 05 as the suction air supply over the entire length of the suction roller 05. The

pipe 21 has a downward oriented air slit 22 of a width of, for example, 6 mm over the length of the suction roller 05.

It is also conceivable that the suction roller 05 has suction holes 06 all around, revolves rhythmically or freely, and that the suction air is supplied in a clocked manner via a slit-like mouthpiece 22 inside the suction roller 05, and directed downward.

In the circumferential direction, the suction roller 05 has several segments with suction holes 06, wherein each segment picks up a different sheet 10, 11, 12 to be aligned by means of suction. The suction roller 05 preferably has two segments in the circumferential direction.

Where, in accordance with Fig. 2, the cover marks/guide tongues 04 are located in the bottom of the suction rollers, i.e. near the suction roller grooves, the suction slit 22 in the pipe 21 is not cut through, which increases the stability of the suction pipe 21. The vacuum is switched extremely rapidly, since it is maintained in the pipe 21 and only the air holes 06 close to the mouthpiece must be emptied by suction. With the suction tube 05, the spaces between the two active suction elements 06 have been placed slightly lower. This makes it easier for the offset first sheet 10 running into the press to leave the feed table 01 without interference next to and parallel with the suction roller center.

In Fig. 3, the incoming third sheet 12 is located within the scale tolerance strip 13 to the right of the side mark 03 and to the left of the center of the suction roller 05, i.e. actually in the suction area 22. However, since the second sheet 11 lies on top of the third sheet 12, and the second sheet 11 is pulled against the side mark 03 by the suction roller 05 from

above, the third sheet 12 cannot be pulled up by suction by the suction roller 05 because it is covered by the first sheet 11. In spite of the operating side pull mark 03, the third sheet 12 can continue to move unhindered in the direction of the front marks 02.

Fig. 3 illustrates an example of the drive mechanism for the suction roller 05 located above the feed table 01, which is driven at half turns by means of the gear wheel 14, toothed belt 15 and drive wheel 16. Bevel wheels 17, 18 above the feed table 01 are connected by a vertical shaft 19 with 2:1 bevel wheels 30, 31 underneath the feed table 01. A feather key 32 has been screwed into the bevel wheel 31 and engages a continuous groove 33 of a single turn shaft 34, which rotates transversely underneath the feed table 01. A slit, which can be covered over, is located in the feed table 01 above this single turn shaft 34 for letting the vertical bevel wheel drive shaft 19 through from below to above. In this way the entire unit, consisting of the suction pull mark with drive mechanism, can be shifted transversely in relation to the sheet running direction L, depending on the sheet width, to SI (control side) or, with a mirror-reversed suction pull mark unit, to SII (drive side) of the printing press.

It can also be seen in Fig. 3 that, for gaining sheet-feeding time, three sheets are simultaneously present in the pull mark area in a novel way, while in the customary way there have been only two sheets up to now.

Fig. 4 represents a way/time diagram of the sheet feeding device with a classic pull guide ZM in a position of -150 mm from the zero line. The abscissa describes the active time angle of a single turn shaft, for example a plate cylinder, from 0° to 360°, the ordinate shows the sheet travel in mm.

The first sheet at the left outside is accelerated in the 90° time angle, for example by means of swinging auxiliary grippers, in a parallel manner to the circumferential speed of the cylinder, and leaves the front mark line in the form of a 45° straight line equal to the abscissa.

A second sheet runs more slowly in the sheet stream with a scale length SL = 300 mm and encounters the front marks at 210°. It is in contact with the front mark over 80°, i.e. until 290°. Then the classic lateral pull mark is engaged, which had already been released from the outgoing first sheet of a maximal length of 720 mm. The pulling time is 60° until the pull mark opens at 350°. Only then is the third sheet 12 allowed to pass through the pull mark line -150 mm of the front marks which, with a 210° arrival point forces, the relatively large scale distance of SL = 300 mm. Sheets of excess length of, for example 850 mm length, cover the pull mark. In that case it must be a suction pull mark from underneath.

Fig. 5 represents an improved way/time diagram with the side pull mark in accordance with the invention, which pulls the sheet by means of suction only from above. The beginnings of the sheets and the ends of the sheets move the same as in Fig. 4. The second sheet arrives considerably earlier at the front marks, namely at 140°, and has a contact time of 120° until 260° when the pull mark starts.

The scale distance SL is only 180 mm, because the third sheet need not wait for the opening of the pull mark, as in Fig. 4. The third sheet 12 can pass underneath the working pull mark and can therefore already be in the 120 mm long area of the pull mark suction roller of 250 mm - 130 mm, this permits the more

advantageous, because it is shorter, scale distance of only 180 mm.

At a normal maximum sheet length of 720 mm, the sheet end passes the pull mark suction roller before the latter begins to operate from 260° to 350°, i.e. with a 90° pull time.

With sheets of excess length, for example 850 mm long, or 306° of 1000 mm cylinder circumference, single turn, the outgoing end covers the working suction pull mark. In such cases the outgoing sheet must be laterally offset, for example by 26 mm, in order to release the pull mark in good time at 260°.

The comparison of Fig. 4 with Fig. 5 shows that the feed times are longer by 50%, namely at the front marks 120° instead of 80°, and at the lateral pull value 90° instead of 60°. This is possible because not only the respectively second sheet, but also already the third sheet, can be in the area between the pull mark mechanism and the front marks 02. This allows at the same time an advantageously short scale distance at a lesser speed and with less danger of rebound when contacting the front marks.

The invention is not limited to the exemplary embodiment.

List of Reference Symbols

01	Feed table
02	Front mark
03	Side mark
04	Cover mark, guide tongue
05	Holding device, suction roller
06	Suction holes, suction air holes, suction segments, holding surface
07	Bearing arms
08	-
09	Hose
10	Sheet, first
11	Sheet, second
12	Sheet, third
13	Tolerance strip
14	Toothed belt pulley
15	Toothed belt
16	Drive wheel
17	Bevel wheel
18	Bevel wheel
19	Shaft, vertical, bevel wheel driveshaft
20	-
21	Pipe
22	Air slit, slit mouthpiece
23	Straight line
24	Straight line
25	-
26	-

27	-
28	-
29	-
30	Bevel wheel
31	Bevel wheel
32	Feather key
33	Groove
34	Single turn shaft
A	Constant amount, distance
B	Constant amount, distance
L	Running direction, sheet running direction
l05	Length of the holding surface, longitudinal direction
b05	Width of the holding surface, transverse direction
ZM	Pull mark
VM	Front mark
SL	Scale length, scale distance